COOKING DEVICE

The invention relates to a cooking device comprising a cooking chamber and a lighting unit for illuminating the cooking chamber, which has at least one reflector comprising at least one first reflector surface which reflects the light from a light source of the lighting unit into the cooking chamber as diffuse scattered light.

Known from DE-A-38 08 716 is a device for illuminating the interiors of household appliances. The illumination device is built into the baking oven door and has arched reflectors which are constructed as elongated and have a parabolic cross-section and are arranged so that they run at the height of the viewing window. A plurality of illuminants are preferably associated with the reflectors. A glare-free and overall uniform interior illumination of the baking chamber or the cooking chamber at all loading levels is thereby achieved without a breach in one of the baking chamber walls.

Known from DE-A-36 43 354 is a further illuminating device for a baking oven closable by a baking oven door. Lamps and associated sloping reflector surfaces are arranged in an interior space of the baking oven door. Optimal illumination of the baking compartment is thereby achieved wherein the lamps cannot be seen from outside.

The object of the invention is to provide a cooking device with a cooking chamber which is illuminated in a visually appealing manner.

The object of the invention is solved by a cooking device having the features of claim 1. According to the characterising part of claim 1, the reflector has at least one second transverse reflector surface running

transversely to the first reflector surface, which reflect the light from the light source into the cooking chamber in a focussed manner. The second transverse reflector surface according to the invention reflects the light from the illuminating device into the cooking chamber in a focussed manner such that food located on the baking sheets is visually emphasized. On the other hand, the first reflector surface reflects diffuse scattered light for uniform illumination of the cooking chamber.

It is especially preferred if the second reflector surface reflects the light into the cooking chamber in the form of a light cone which expands in the direction of the food. This ensures intensive illumination of the food over a large area.

Alternatively, it can be visually preferable if the beam profile of the light reflected from the transverse reflector surface is directed almost parallel to the food. In this case, the focused light is incident on a relatively small surface area of the baking sheet.

For focusing the light of the illuminating device, the transverse reflector can be flat or arched in the direction of emission. In this case, the transverse reflector surface is aligned as an arched mirror in the direction of the cooking chamber.

It is advantageous if one of the reflector surfaces is used to deflect the light from the light source towards further transverse reflector surfaces. In this case, the light source can be arranged spatially separated from the reflector. In this case, it is sufficient if the light source is merely in optical communication with the deflecting transverse reflector surface in order to deflect the light to the further transverse reflector surfaces.

The first reflector surface can preferably be constructed as flat or convexly arched in the direction of emission. In this case, the first reflector surface achieves a particularly good light scattering effect whereby all edge zones of the cooking chamber are adequately illuminated.

From the manufacturing technology point of view, it is preferable if the first and second reflector surfaces are constructed in one piece with the reflector. In this case, the reflector can be made of a plastic injection moulding, for example whose reflector surface is reflection-coated. In this case, the different reflector surfaces are aligned with respect to one another during manufacture of the reflector. It is particularly preferable if the reflector material has a low coefficient of thermal expansion since any distortion of the reflector under thermal stressing is thus reduced. This ensures a permanently optimal alignment of the first and second reflector surfaces with respect to one another.

A particularly harmonious illumination of the cooking chamber is achieved if a transition between the first and the second reflector surface is rounded. A continuous transition of the luminous intensity between the focused light and the diffuse scattered light is thereby achieved. In this connection, it is also advantageous if the surface structure of the second reflector surface is roughened. The second transverse reflector surface thus produces not only focused light but also a small fraction of diffuse scattered light. A continuous transition of the luminous intensity between the focused light and the diffuse scattered light is likewise achieved hereby.

It is particularly advantageous if the reflector is arranged in a cooking device door for closing the cooking

chamber. In this case, glare-free illumination of the cooking chamber can be achieved since the reflector reflects the light from the light source into the cooking chamber in a viewing direction of the user.

The light source of the illuminating device can advantageously be arranged outside the cooking device door and emit light onto the reflector arranged inside the cooking device door. Thus, an arrangement of the light source spatially separate from the reflector can be executed. In this case, vibration-sensitive lamps can also be used since the light source is not exposed to any vibrations during opening and closing of the cooking device door.

It is preferable if the first reflector surface of the reflector is constructed as a curved groove shape. In this case, a U-shaped or parabolically constructed groove shape of the first reflector surface is particularly advantageous to obtain an optimal light distribution of the diffuse scattered light in the cooking chamber. Furthermore, the first reflector surface can advantageously delimit a light guiding compartment. The light from the light source collects therein and is reflected from there into the cooking chamber. Losses of light accompanying reflection of the light at the reflector are thereby reduced. It is advantageous if the transverse reflector surface which reflects the focused light into the cooking chamber is arranged inside the light guiding compartment.

In order to achieve a light-guiding compartment which is largely closed towards the outside, front ends of the curved groove-shaped first reflector surface are closed by transverse reflector surfaces. The reflector thus acquires an advantageous tub shape which reduces loss of light at its front ends.

It can be advantageous if the reflector has a light channel which is opaque towards the outside. The light can be transmitted through the light channel without losses of light between spaced reflector surfaces. The loss-free transport of light in the reflector increases the light yield.

It is especially advantageous if the light guiding compartment of the reflector is closed on the interior side of the door. Losses of light in the interior of the door can thereby be largely reduced. In this case, it is preferable if the reflector together with a door inner pane facing the cooking chamber closes the light-guiding compartment. A light gap through which light escapes into the interior of the door is largely avoided.

An exemplary embodiment of the invention is explained hereinafter with reference to the appended figures. In the figures:

Figure 1 is a perspective view of a cooking device with the cooking device door open;

Figure 2 is a side sectional view of a section of the cooking device;

Figure 3 is a perspective view of the cooking device door with a door inner pane partly broken away;

Figures 4a to 4c show a reflector arranged in the cooking device door viewed from above and from the side and in a perspective view; and

Figure 5 shows a front view of the cooking device without the cooking device door and in a partial section.

Figure 1 shows a cooking device comprising a rectangular baking chamber 3. The baking chamber 3 has a front baking-chamber opening 5. Horizontal slide-in ribs 7 are constructed on both side walls of the baking chamber 3 These are used to slide in and support baking sheets in horizontal cooking chamber levels. The front baking chamber opening 5 can be closed by means of a front cooking-device door 9. This is pivotally hinged in the lower area of the cooking device by means of lateral door hinges 11. The baking-chamber opening 5 is bordered by a front baking-chamber flange 13. Affixed to the baking-chamber flange 13 is a ring seal 14 which extends around the baking-chamber opening 5 on the circumferential side.

Figure 2 shows the cooking device with the cooking-device door 9 closed. In this case, the cooking device door 9 abuts against the ring seal 15 with its inner side facing the cooking chamber 1. The front baking-chamber flange 13 is located at a distance of around 7 mm from the cooking device door 9 by means of an intermediate space 16. Attached to an underside of a bottom of the baking chamber 3 of the cooking device is a heating element housing 17, as shown in Figure 2, which holds an underheat heating element 18. The heating-element housing 17 extends as far as close to the front baking-chamber flange 13. Likewise arranged underneath the bottom of the baking chamber is a baking oven lamp 21. Its housing 22 is held in the front baking-chamber flange 13. The light from the lamp 21 is reflected into the cooking chamber 1 via the cooking-device door 9.

The structure of the cooking device door 9 can be seen from Figure 3. Consequently, the cooking-device door 9 has a rectangular doorframe 25 made of a deep-drawn sheet metal,

which runs around the circumference. A door handle 27 is affixed on an upper frame strip of the door frame 25. The cooking device door further has a door inner pane 29 facing the cooking chamber 1 and a front door outer pane 31 which are spaced apart from one another. For cleaning reasons the door inner pane 29 is held detachably on the door frame 25 by means of snap-in connections which are not shown. The front outer pane 31 on the other hand is fixedly connected to the door frame 25. The two panes 31 and 29 are made of a transparent glass ceramic material and have opaque printing 33. These each surround transparent rectangular viewing areas or viewing windows 34 of the door panes 29, 31. The door frame 25 together with the door panes 29, 31 spaced apart from one another delimits a door interior space 37 which is adequately sealed against moisture from the outside. In the lower corner areas of the door frame 25 it is possible to see movable hinge portions 26 of the door hinges 11 which are fixed inside the door frame 25. The movable hinge portions 26 can be suspended in corresponding fixed hinge portions of the door hinge 11 on the housing side.

Located inside the door interior space 37 are two elongated reflectors 39 as shown in Fig. 3. These are arranged so that they are hidden from view behind the printing 33 of the door outer pane 31 and extend along the sides of the viewing window 34. The reflectors 39 are made of a solid plastic injection moulding which is resistant to thermal stresses and is stable in shape. One of the reflectors 39 is shown in Figures 4a to 4c. Accordingly, the reflector is constructed as having an almost U-shaped cross-sectional profile so that it extends in a groove shape in one longitudinal direction. The reflector 39 has a flat groove bottom 40 which is surrounded by raised longitudinal side walls 41. The groove bottom 40 and the longitudinal side walls 41 delimit a light-guiding compartment 49.

Located inside the light-guiding compartment 49 are the transverse reflector surfaces 42, 43, 44 which run transversely to the groove bottom 40 and the longitudinal side walls 41. In this case, the outer transverse reflector surfaces 43, 44 close the opposing narrow sides of the reflector 39. As is shown in Figure 4c, the upper free edges 45 of the outer transverse reflector surfaces 43, 44 and the longitudinal side walls 41 run flush at the same distance from the groove bottom 40. The flush profile of the upper edges 45 is interrupted by a gradation into which a cover described subsequently can be inserted.

Both the groove bottom 40, the longitudinal side walls 41 and the transverse reflector surface 44 are constructed as flat. On the other hand, the transverse reflector surfaces 42, 43 are constructed as spherically arched. Formed on the outside on the longitudinal side walls of the reflector 39 are mounting hooks 46 which are suspended to hold the reflector 39 in corresponding sections of the door frame 35 which are not shown. Formed on the outside on the opposing longitudinal side wall 41 are retaining attachments 47 which can be used to optionally retain a further central door pane which is not shown. Edge transitions 48 between the transverse reflector surfaces 42, 43, 44 and the longitudinal side walls 41 and the groove bottom 40 are constructed as rounded.

It can be seen from Figure 3 that the two reflectors 39 are arranged mirror-symmetrically with respect to one another on the sides of the rectangular viewing window 34. In this case, the reflectors 39 abut with their upper free edges 45 against the door inner pane 29 or are only slightly at a distance therefrom. Thus, the reflector 39 together with the door inner pane 29 delimits a light-guiding compartment 49 which is substantially closed on the interior side of

the door. Alternatively, an additional sealing element can be provided to seal light gaps between the free upper edge 45 of the reflector 39 and the door inner pane 29. Escape of light from the light-guiding compartment 49 into the door interior space 37 is thus extensively reduced.

Provided in the printing 33 of the door inner pane 29 are additional transparent areas 51 which project from the sides of the rectangular viewing window 34. The transparent areas 51 extend in the upper area of the viewing window and are aligned with the light-guiding compartment 46 of the reflectors 39. Light reflected by the reflector 39 can be reflected into the cooking chamber 1 through the transparent areas 51 of the door inner pane 29. Further, circular optical windows 53 are formed in the lower area of the door inner pane 29, which are likewise transparent areas in the printing 33. The optical windows 53 are aligned with the transverse reflector surfaces 44 of the reflectors 39. Thus, all focused light from the lamp 21 passes through the corresponding window 53 onto the opposing transverse reflector surface 44. The transverse reflector surface 44 is positioned obliquely with respect to the groove bottom 40 so that the incident light is guided into the light-guiding compartment 49 as indicated in Figure 2.

Consequently, a beam path of the light between the transverse reflector surfaces 42, 43, 44 runs substantially parallel to the longitudinal side walls 41 and to the groove bottom 40. In this case, some of the light is incident on the middle transverse reflector surface 42 and is reflected therefrom into the cooking chamber 1 as a light cone K. The middle transverse reflector surface 42 is located in the light-guiding compartment 49 below the upper edge 45 of the reflector 39. As a result, a light penetration gap 54 is obtained between the middle

transverse reflector surface 42 and the door inner pane 29, as shown in Figure 2. Some of the light is passed on through this gap to the transverse reflector surface 43 positioned thereafter. This reflects the lights into the cooking chamber 1 as a further light cone K. In this case, the transverse reflector surfaces 42, 43 are aligned such that their light cones K irradiate the cooking chamber 1 obliquely downwards. Thus, only the upper side of baking sheets arranged in the cooking chamber 1 is advantageously illuminated.

The reflectors 39 are fully reflection-coated on the inside. A small fraction of the light guided into the light-guiding compartment 49 of the reflector 39 is thus reflected into the cooking chamber 1 as diffuse scattered light D at the reflection-coated longitudinal side walls 40 and the groove bottom 41 (see Figure 2). The longitudinal side walls 40 and the groove bottom 41 serve as additional longitudinal reflector surfaces in addition to the transverse reflector surfaces. The diffuse scattered light D is reflected into the cooking chamber 1 at arbitrary angles. As a result of the combination of the focussed light cones K with the diffuse scattered light D, the following is achieved: on the one hand, food on the baking sheets in the cooking chambers is visually emphasised by the light cones K. On the other hand, however, edge zones in the cooking chamber 1 are also adequately illuminated by the diffuse scattered light D. As a result of the rounded transitions 48 between the first and second reflector surfaces the low light intensity of the diffuse scattered light D goes over continuously into the high light intensity of the light cones K. Such a continuous transition of the light intensity is further improved if the transverse reflector surfaces 42, 43 are roughened. As a result, a small portion of the light reflected into the

cooking chamber by the second transverse reflector surfaces 42, 43 is reflected as diffuse scattered light.

According to Figure 3, the open upper side of the reflectors 39 is covered by a cover 56, which is reflection-coated on the inside, in the area between the middle transverse reflector surface 42 and the lower transverse reflector surface 44. An opaque light channel 59 is thereby formed in the reflector 39. This ensures that the light from the lower transverse reflector surface 44 is guided with almost no losses of light to the middle transverse reflector surface 42. For aesthetic reasons the cover 56 is arranged out of sight behind the printing 33 of the door inner pane 29. The cover 56 is arranged in a gradation made in the upper free edge 45 and ends flush with the upper free edge 45 of the reflector 39.

The lamp 21 is arranged in the lamp housing 22 as shown in Figure 2. The lamp housing 22 is constructed as hollow-cylindrical and is aligned so that it slopes upwards at an angle of about 10° in order to increase the distance from the underheat heating element 18. The lamp housing 22 is held by its open front end in the front baking-chamber flange 13. The end of the housing held in the baking-chamber flange 13 is surrounded by a frame-like light channel element 58. The light channel element 58 is positioned on the baking-chamber flange 13 at the front. It thus projects into the intermediate space 16 between the baking chamber flange 13 and the door inner pane 29.

When the cooking device door 9 is closed, a face of the frame-like light channel element 58 projecting into the intermediate space 16 abuts against the door inner pane 29 or is only a short distance therefrom. In Figure 2 this distance is about 1 to 2 mm. The light channel element 58 thus forms a light channel sufficiently closed with respect

to the intermediate space 16 through which the light from the lamp 21 can be transmitted into the cooking-device door 9. Disadvantageous light effects in the bottom area of the cooking device can thereby be largely avoided. At the same time, the light is transmitted from the lamp 21 on the side of the cooking device to the transverse reflector surface 44 on the door side almost without losses.

In order to reduce heat dissipation from the cooking chamber 1, the cooking chamber 1 together with the heating element housing 17 is surrounded by a heat-insulating jacket 61. The heat-insulating jacket 61 almost completely fills a housing area provided outside the baking chamber 3 of the cooking device.

As can be seen from Figure 5, a separating plate 63 is provided in the housing compartment in the area of the lamp 21. The separating plate 63 forms a hollow chamber 65 separated from the heat-insulating jacket 61 in which the lamp 21 is located. The separating plate 63 serves as an additional heat protection between the lamp 21 and the underheat heating element 18. Also provided in the hollow chamber 65 is a fixed hinge portion 67 of the door hinge 11. The hinge portion 67 is usually made of a solid deep-drawn metal sheet and has a correspondingly high heat storage capacity. In this case, the lamp 21 is also located only at a small distance over about 5 cm from the fixed hinge portion 67 of the door hinge 11. Waste heat produced by operation of the lamp 21 can thus be diverted to the fixed hinge portion 67 by means of thermal radiation indicated by the arrows in Figure 5. The operating temperature of the lamp 21 is thereby reduced and its lifetime correspondingly increased.

In order to further reduce the operating temperature of the lamp 21, the hollow chamber 65 can form a part of an air-

guiding channel 67. The air-guiding channel 67 has air entry slits 69 on the side of the housing bottom through which air can enter into the channel 67. The air-guiding channel 67 extends vertically upwards outside the baking chamber 3 of the cooking device as far as a blower chamber 69 provided above the baking chamber 3 of the cooking device. Provided in the blower chamber 69 is a known cool air blower arrangement 71 which sucks air from the blower chamber 69 in the direction of the arrows in order to cool electronic components of the cooking device. According to the invention ambient air is initially sucked into the hollow chamber 65 at the bottom. In this case, the air which has been sucked in flows around the lamp 21 in the direction of the arrow and is guided into the blower chamber 69 via the air-guiding channel 67.